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Bibliometric Review on Applications of Disease Detection using Digital Image Processing Techniques

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Bibliometric Review on Applications of Disease Detection using Digital Image Processing Techniques

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Abstract

Advances around the field of deep learning and cognitive computing have allowed mankind to look and solve the problems of the world in a completely new way. Deep learning has been making huge advancements in the field of healthcare, which most importantly focuses upon disease detection and disease prediction. Techniques such as these have been conceptualized the idea of early detection and economical ways of treating the predicted disease in particular. Still, it has been observed that there seems to be no change in the way diagnosis of a particular disease takes place even in the 21st generation of medical health care. The highlight of the reasons happens to be lack of trust, lack of awareness and lack of infrastructure. In this paper we will discuss three disease prediction models and the impact their adoption will provide to millions of lives. The diseases are brain tumour, pancreatic cancer and covid-19. This paper focuses upon the impact of how the adoption of deep learning and artificial intelligence will have a huge positive impact and conceptualize a new way of medical imaging. here we have talked about the adoption of deep learning in models in today's healthcare scenario and also the crucial role of delivering such applications to the user.

Keywords: Convolution neural network, Classification, Deep learning models, Medical image analysis, Support vector machine, k-means clustering, Hybrid convolution neural network.

1. Introduction

Medical image analysis is one of those fields which have seen some breakthrough research and provides applications such that will benefit millions of people. An important aspect to focus on Medical image analysis is the algorithm on which it is based upon. Machine learning (ML) algorithms can be defined as programs that understand the complexity of the task they are designed for and are able to perform better as and when they are exposed to more and more data. Such machine learning algorithms were first introduced in 1960 by Arthur Samuel. These algorithms are designed employing the logics of statistics and mathematics which make the deep learning model accurate and functional. To build such accurate disease models it is desirable that these models work on well-designed neural networks. A disease prediction model's building blocks are neural networks. They are used in a variety of financial services applications, ranging from forecasting and market research to fraud detection and risk assessment. The fundamental benefit of a neural network is that it adds computational capabilities to the model, reducing the need for human interaction in the model's operation [1]. Some neural network that we have studied are convolution neural networks, recurrent neural networks and artificial neural networks.

2. Literature Survey

Automated disease detection in medical imaging is turning out to be an emerging field in the different sectors of medical diagnostic applications. The idea of image classification using ML can help detect some specific disease at an early stage, even diseases as crucial as brain tumor, pancreatic tumor, covid-19 etc. The Automated detection of tumor in magnetic resonance imagining (MRI) is very crucial as it provides information about abnormal tissues which is necessary for the planning of the specific treatment. The known conventional method for defect detection in MRI brain scans is human inspection. We can also say that this method can turn out to be impractical for large amounts of data. So, automated tumor detection methods are developed as it would save the time of the radiologists.

Covid-19 has infected over 100 countries and has killed a number of people. The Covid-19 pandemic has affected millions of people. The detection of disease with the use of various artificial intelligence (AI)/ML techniques could be one of the answers to regulate the current chaos. Pancreatic cancer is one of the most common cancers in the world. According to a recent research from the American cancer society, about 60,420 persons (31,930 men and 28,480 women) would be diagnosed with pancreatic cancer in the United States in 2021. This disease will kill approximately 48,210 persons (25,260 males and 22,950 women). It is well known that pancreatic tumors can be healed if caught early enough, and with the help of these modern ML algorithms it will be possible to diagnose the condition at the appropriate moment. In this article, we'll look at three disease prediction models and the influence that their adoption will have on millions of people's lives. Brain tumor, pancreatic cancer, and covid-19 disease models are the disorders. This study focuses on how deep learning and AI adoption will have a major positive impact and construct a new way of medical imaging in many parts of the world. We have discussed the utilization of deep learning in models in today's healthcare environment, as well as the critical function of delivering such applications to users.

Machine learning (ML) and deep learning (DL) methods for the detection and grading of various malignancies utilizing various imaging modalities have recently become increasingly prominent in the field of medical image analysis. Researchers have developed a system that combines discrete wavelet transform (DWT) characteristics with deep learning (DL) approaches using a convolution neural network (CNN). The brain tumor is segmented using the fuzzy c-mean approach, and for each identified scan, the DWT was used to extract the appropriate features, which were then input into the principal component analysis (PCA) for feature dimension reduction before being input to deep neural networks (DNN). Their model had a 97.0 percent sensitivity rate and a 96.97 percent accuracy rate. They extracted four distinct features (energy, correlation, contrast, and homogeneity) for each image, which in this case is an MRI scan of the brain, utilizing the four angles (0°, 45°, 90°, and 135°) using this method. Meningioma-glioma dataset (Mg-Gl), meningioma-pituitary tumor dataset (Mg-Pt), Glioma-pituitary tumor dataset (Gl-Pt), Meningioma-glioma-pituitary tumor dataset (Gl-Pt), Meningioma-glioma-pituitary tumor dataset (Mg-Gl-Pt). These four datasets were donated by China's school of biomedical engineering. On applying the CNN, the best accuracy achieved was 82.27% for Gl-Pt dataset using two sets of features that were contrast with homogeneity and contrast with correlation [2], [3]. A deep CNN based framework for brain tumor recognition and reviewing was introduced. The framework utilized the idea of fuzzy c-means (FCM) for brain division and upheld these sectioned regions and shape highlights were removed then these highlights were taken care of into support vector machine (SVM) and DNN classifiers. The outcomes showed that the framework was able to accomplish a value of 97.5% accuracy [4]. Later on, another system was proposed in which the method used for better performance of the brain tumor classification process using region of interest (ROI) augmentation and fine ring-form partition. They applied such methods to different feature extractions methods which are intensity histogram, GLCM, and therefore the bag-of-words (BoW) where these features vectors are fed into a classifier. The experimental results showed that the accuracy enhanced from a mere 70.59% to 79.28%, and 82.54% to 88.54%, and 88.92% to 90.98% for intensity histogram, GLCM, and BoW, respectively. Another research based on non-invasive segmenting and categorizing of glioma brain tumors employed a modified version of the Convolution Neural Network (CNN). The classification process was done using a complete scan of the MRI images of the brain and therefore the labels of the pictures were not at the pixel level but instead on the image level. The experimental results showed that this method achieved an inexpensive performance with an accuracy of 91.36% [5]. Sajjad, Muhammad et al. [6] researched on a system which used a through data

augmentation method fused with the CNN for brain tumor classification. The said method used the multi-grade classification of brain tumors using segmented MRI images of the brain. They used the pre-trained VGG-19 CNN architecture for classification which achieved an accuracy of 87.58% and 90.47% for data before augmentation and after augmentation respectively. While Özyurt, Fatih et al. [7] merges the methodologies of CNN with neutrosophic and expert maximum fuzzy entropy for brain tumor classification. They used the neutrosophic set and expert maximum fuzzy-sure entropy method for brain tumor segmentation and later these images are passed onto the CNN to extract features and then fed to the SVM classifiers which is a machine learning algorithm, to be classified as benign or malignant. They achieved a mean success of 95.68%. In this bibliographic review paper, we have gone through close to 34 research papers from the Scopus directory where we have inferred the following observations which will prove to be useful in our proposed system. According to a study published on the subject of fusion and extraction of features from a deep neural network, a technique was suggested that utilizes fusion attribution to represent images better for face recognition by attribute extraction by a deep CNN. They used PCA to reduce the capacity of the fused attribute. The SVM machine classifier is implemented for two classes. Experimental outcomes display that this technique can distinguish faces with severe occlusion and significant confusion and scale differences. The conclusion mentions that this technique reaches an 89% recall rate on FDDB and was also found to be 97% accurate [8]. Er-Yang Huan et al. [9] recommend a body constitution acknowledgment system grounded on CNN which will perceive individual constitution sorts based to confront pictures. The proposed model initially uses CNN to extricate the face picture ascribes and afterward melded the preoccupied highlights with the tone credits. The joined subtleties are headed to the Soft-max classifier to get the gathering result. They express that the strategy recommended during this work can arrive at a precision of 65.3%. A new and innovative method had also been introduced in which a cycle of functions was designed to extract brain tumors from 2D MRI brain utilizing a fuzzy c-means gathering method followed by traditional calculations and CNN. The observational exploration was directed on a genuine time dataset with various malignant growth measurements, spots, designs, and different picture qualities. The old-style calculation area applied six customary classifiers, especially SVM, k-nearest neighbors, multilayer perceptron, logistic regression, naïve bayes, and random forest, whatever were applied in scikit-learn. At that point, applied CNN utilizing keras and tensorflow as it delivers more solid accomplishments than ordinary ones. CNN got an exactness of 97% [10]. Research outlines the favored procedures utilized in paragraph attribute extraction first then extend repeatedly used DL process in paragraph attribute extracted and its implementation and forecasts the appliance of deep learning in attribute abstraction. They conclude that associated with other machine learning approaches. DL can distinguish complex interactions from the attribute and train lower-level attributes from almost unprocessed primary information [11]. In the paper brain tumors classification using learning neural networks by Heba Mohsen et al. [12], they applied the deep neural network (DNN) to categorize the MRI data set of 66 brain tumor images. They conclude that using the DNN algorithm demonstrates great accuracy associated with standard classifiers. An efficient and operative way utilizes a convolutional network applied for grouping and segmentation. The suggested approach applied ImageNet for abstract attributes. The outcomes achieved 97% and 84% precision for grouping and segmentation, respectively [13]. DL structures, and base neural frameworks for disease ordering by MRI pictures are thought of and assessed. The results show that the framework routine grounded on the sensitivity and specificity of the convolutional network better by 19% identified with ANN [14].

A new approach that uses CNN to classify brain tumors into benign and three types has been proposed. Using an enhanced ICA composite model, the tumor is predominantly segmented

from MRI images. Features are extracted and placed after the image has been segmented. This research examines the quantitative characteristics of brain tumors such as form, texture, and signal intensity in order to predict clinical outcomes such as the presence of tumors and treatment response [15]. Many conclusion studies have been conducted to investigate the role of CNNs in segmenting brain tumors by first conducting an enlightening look into CNNs and then doing dissertation research to obtain an example segmentation pipeline. Also, to look into the long-term efficacy of CNNs by looking into a new field called radionics. This research examines the quantitative characteristics of brain tumors such as form, texture, and signal intensity in order to predict clinical outcomes such as the presence of tumors and treatment response [16]. A research suggests that the detection of a brain tumor by applying CNN and artificial neural network (ANN) classification in a sequential way. Small kernels designed, and neuron weight to obtain more in-depth architecture. Investigational outcomes display that the CNN records 97% accuracy with little complication and therefore the recent approaches [17]. After inferring from the confusion matrix and results from the algorithm the Network records 74% accuracy. The auto distinguish technique is applied to classify cancer utilizing a convolutional network within three kernels. The technique achieved the complete core's initial location concurrently and improved areas in dice likeness and quantity metric 0.87, 0.82, and 0.76 [18]. A research conducted on the subject of DL and its role in covid-19 which aimed at diagnosing and detection of coronavirus-19 disease through various radiology modalities such as x-rays and CT scans. This model was able to provide was higher than 92% [19]. During the study of a CNN algorithm, the CNN algorithm is applied to abstract target attributes from the sonar photos. The SVM is implemented within the recognition stage, which was trained supported manually labelled data. The result demonstrates that deep learning attribute extraction provides [20].

Applications of DL is a subject centered around how the actual applications of DL in medical is making a difference and saving millions of lives. It talked about different techniques such as medical imaging, History of medical imaging, CNN, supervised learning models and clustering [21]. At present a method for the CNN calculation and data augmentation and picture preparing to sort mind MRI filter pictures into threatening and non-dangerous. Examining the results of the scraped CNN calculation using VGG-16, ResNet-50, and Inception-v3 models that were previously prepared. In the end, the model's precision was 99.95 percent, while VGG-16's was 95 percent. ResNet-50 had an accuracy of 87 percent, while Inception-V3 had an accuracy of 78 percent [22].

Here, we discussed different methods that can used in image classification models by various researchers such as VCG-16, ResNet-50 and Inception V3 models. These methods are essential for developing a CNN algorithm for disease detection and prediction.

Table 1: Accuracy Results of various different image classification methods [23]

Methods	**ACC**	**IoU**	**DSC**	**AUC**
ResNet-50	0.98	0.62	0.67	0.77
VCG-16	0.95	0.56	0.64	0.75
Inception V3	0.97	0.68	0.69	0.90

3. Medical Imaging Types

The conceptualization of medical image analysis was introduced way back in 1895 by the invention of x-ray by the German professor Wilhelm Rontgen. Since then, medical image analysis has seen huge advancements which included computer tomography (CT) scan and Magnetic resonating imaging (MRI) scans in the 1970s. Over the last 120 years, from the

introduction to a simple x-ray medical image analysis has seen huge advancements and has significantly improved in terms of accuracy and precision. The figure below comprises of MRI scans, ultrasound scans, x-rays, positron emission tomography and mammography. It is important to state the fact that each of these types of medical analysis types require different algorithmic architecture to be designed in the context of processor and memory limitations. medical imaging analysis has key significance in the healthcare field such as early detection of cancers and tumours. There are at times when the presence of milder cancers and tumours are not successfully predicted by medical healthcare doctors and at times it becomes very late for the patient to seek a treatment. Early detection of cancers and tumours with the help of artificial intelligence techniques has been able to help the medical healthcare doctors to provide a conclusive decision to the patient and has helped save millions of lives. Digital image processing forms the roots of creating a DCNN for disease detection. By using such techniques, a lot of time and effort is saved and increases efficiency. Another key features of using such techniques in the healthcare field is that it enables such models to assess their performance and train itself without any human intervention due to the presence of artificial intelligence [24]. In this research paper. In this paper we have formulated the concept of creating deep learning models for three diseases which can be available on a single server. The three diseases that we will be focusing on brain tumour detection, pancreatic tumour detection and Covid-19 detection models.

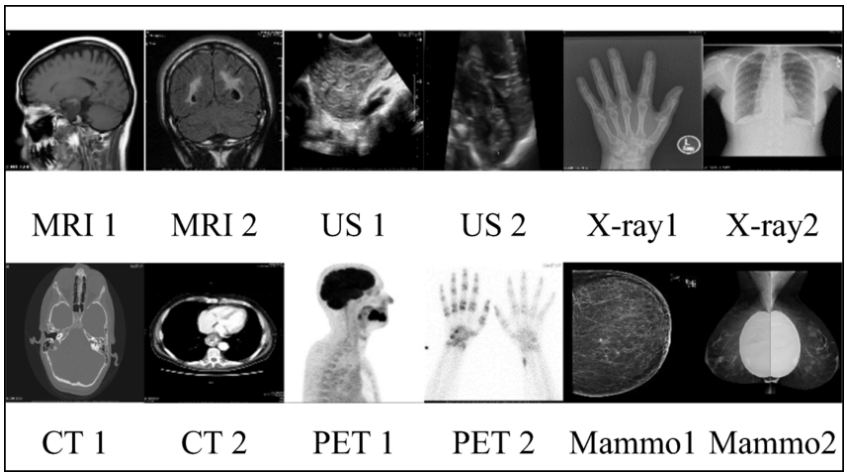


Figure 1: Types of Medical Scans
Source: northcentralsurgical.com

4. Disease Prediction Models

Disease prediction models are developed in modern healthcare to estimate the likelihood of a disease occurring which is predicted by taking into account relevant risk factors such as age, sex, and clinical scans such as x-ray, MRI or CT. Models with such self-computing techniques are becoming more and more common, influential and key factors in determining a medical consultation. Recent research has shown that the approach most favored for such applications is hybrid data mining algorithms. Hybrid data mining algorithms is a combination of logical and statistically created multiple pre-existing techniques to enhance performance, improve accuracy and provide better results [25]. These algorithms apply different methods such as data extraction, data pre-processing, attribute selection, image classification and attribute selection. Such hybrid data mining algorithms are specific to every model and there is one that has been discussed in this paper.

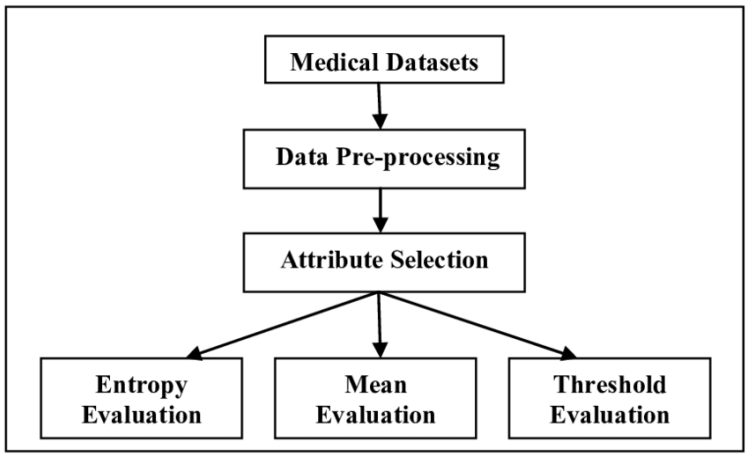


Figure 2: Flowchart for Hybrid data mining model for attribute selection [26]

a. **Medical Datasets and Data Pre-Processing:** The Attribute selection requires few important steps such as selection of medical datasets and a pre-processing of the data. Medical datasets are the collection of database images which will be consisting of various CT scans, X-rays and MRI scans. Data pre-processing is the procedure followed to make the data more applicable to the task. It involves tasks such as data cleaning, normalization, feature extraction and selection.
b. **Attribute selection and mean evaluation:** Attribution Selection usually refers to the reduction in the amount of data for applying the required analysis more efficiently. Based on the size of a dataset, it can have many or less attributes. Mean evaluation is a method to check the effectiveness of a model. It is also used to assess the results of the model for a dataset it has not been tested on.
c. **Threshold Evaluation:** This is a basic method which is used for segmentation of an image in a deep learning model. Using this way, a point is predicted beyond which the change in the system is observed. This method helps us in understanding the accuracy of a model which is very important while developing disease prediction models.

4.1 Brain Tumor Detection Model

The strange collection of cells is formed by uncontrolled cell division, which is also known as a tumor. Poor quality (grades 1 and 2) and high evaluation (grades 3 and 4) tumors are the two types of brain tumors. Poor quality cerebrum tumor is known as favorable. Additionally, the high evaluation tumor is likewise called dangerous. The benevolent tumor isn't a dangerous tumor. Consequently, it doesn't spread different pieces of the minds. Anyway, the harmful tumor is a carcinogenic tumor. So, it spreads quickly with uncertain limits to another district of the body without any problem. It prompts quick death.
The brain X-ray image is primarily used to distinguish the tumor and monitor tumor progression. This information is mostly used in the detection and treatment of tumors. An MRI image contains more information about a medical condition than a CT or ultrasound image. The X-ray image provides precise information on the structure of the cerebrum as well as the discovery of irregularities in the brain tissue. Since it became possible to sweep and freight clinical photos to the PC, researchers have given various computerized strategies for discovering and cataloguing cerebrum cancers and types using mind X-ray photographs. Alternatively, neural networks and SVM are the most commonly used algorithms in recent years because to their widespread acceptance. 11 profound learning models, on the other hand, have recently established a blending pattern in AI, as the underground architecture may

effectively address complex connections without requiring a large number of hubs, as shallow designs like as k-nearest neighbor (KNN) and SVM. As a result, they grew quickly to become the best in class in a variety of health informatics fields, including medical image analysis, clinical informatics, and bioinformatics.

The most commonly diagnosed cancer is brain tumors, which have an extremely low life expectancy. As a result, detecting and arranging treatment is a vital stage in improving patient satisfaction. To assess a tumor in the brain, lung, liver, or prostate, various imaging techniques such as computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound are commonly used. MRI images are specifically used in this study to assess a brain tumor. In any event, the massive amount of data generated by an MRI scan makes manual identification of tumor versus non-tumor in a specific period impossible. However, it has significant limitations, such as the fact that precise quantitative estimations are limited to a certain number of images. To slow the rate of human extinction, a trustworthy and programmed grouping plan is required. The programming of a brain tumor layout is a tough task due to the large geographical and underlying changeability of the tumor's surrounding environment. This article used a CNN arrangement to produce a programmed brain tumor location.

Early location of these tumors is exceptionally needed to give treatment to patients. The patient's life chances are improved by its early identification. The way toward diagnosing the mind tumors by the doctors is regularly done utilizing a manual method of division. It is tedious and a troublesome one. To tackle these issues, hybrid CNN (HCNN) and hybrid data mining strategies (HDMT) is proposed with misfortune work enhancement by BAT calculation for programmed division strategy. The essential point is to introduce streamlining based X-ray's picture division. Little parts permit the plan in a profound design. It has a positive result regarding over-fitting gave the lesser loads are relegated to the organization. Skull stripping and picture improvement calculations are utilized for pre-handling. The trial result shows the better exhibition while contrasting and the current techniques. The looked at boundaries are exactness, review and precision. In future, diverse choosing plans can be embraced to improve the precision.

Meningiomas are the most widely recognized kind of tumors that start in the dainty layers that encompass the mind furthermore, spinal line. Meningiomas tumors are generally considerate. Gliomas are an assortment of tumors that develop inside the substance of the cerebrum and regularly blend with ordinary cerebrum tissue. Glioma's tumors lead to an extremely short future when the size of the tumor is moderately huge. Pituitary tumors are strange development of the synapses. Pituitary tumors as a rule create in the pituitary organ of the cerebrum. Some pituitary tumors result in the strange and risky expansion in the chemicals that direct significant elements of the body. These tumors can show up anyplace from the cerebrum in view of their characteristic nature. Additionally, they don't have a uniform shape. They have various sizes, shapes, and differentiations. MRI Imaging is a clinical imaging procedure, which is widely utilized for conclusion and treatment of mind tumors in clinical practice. The MRI pictures are taken from three unique headings. These perspectives are called sagittal, pivotal and coronal. Cerebrum Tumor segmentation methods are a basic segment in tumor discovery. Utilizing AI methods that get familiar with the example of mind tumor is valuable since manual division is tedious and being helpless to human blunders or errors. Most programmed brain tumor division techniques use hand-created highlights like edges, corners, histogram of slope, neighborhood double example, and so forth. In these strategies, the emphasis has been on execution of an old style. The proposed highlights are first extricated and afterward given to a classifier. The preparation technique of the classifier isn't influenced by the idea of those highlights. CNNs

try not to utilize hand-created highlights and they have been applied effectively to division issues [27]. Brain tumour conclusion requires high precision, where minute blunders in judgment may prompt catastrophe. Hence, brain tumour division is a significant test for clinical purposes. Presently, a few strategies exist for tumour division however they all need high exactness. Here we present an algorithm for brain tumour prediction by utilizing deep learning in the form of a HCNN.

4.2 Covid-19 Detection Model

SARS-CoV-2 began in Wuhan, China, and quickly spread over the world, resulting in a global epidemic. The response has been a jumbled mess of mostly chaos and a little good faith. Researchers hastened to share the infection's entire genome, and individuals all over the world sequestered themselves to stop the spread. Researchers have lowered the barriers to collaboration. Nonetheless, the pandemic has resulted in a slew of negative consequences. The speedy contamination and absence of assets has over-burden emergency clinics and vigorously troubled medical services laborers. SARS-CoV-2 has a remarkable quality of pinnacle contamination before side effect indication that has worked in the blessing of the infection. Deception has spread so wildly, another field of "infodemiology" has grown to battle the "infodemic". Disarray of right data is compounded by a quickly developing assortment of writing encompassing COVID-19. This exploration is a rising rapidly, and new apparatuses are expected to assist researchers with getting sorted out this data.
In this paper, we examine a portion of the manners in which that artificial intelligence has assumed a part helping with this pandemic, especially according to the perspective of thoracic imaging. Chest X-beam and chest CT are the two most normal imaging reads for determination and the board of COVID-19 patients [28].

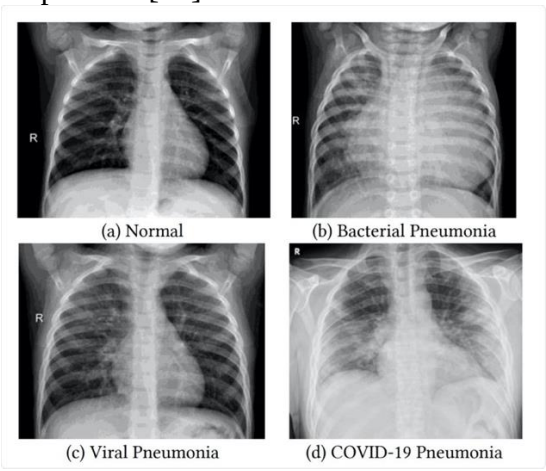


Figure 3: Examples of frontal-view chest X-Ray images from the datasets. [29]

4.3 Pancreatic Tumors

Pancreatic cancer is expected to be diagnosed in 61,450 persons in the United States (32,960 men and 28,490 women). This type of cancer accounts for around 3% of all cancers. In women, pancreatic cancer is the eighth most common cancer, and in men, it is the tenth most common cancer. In the research and identification of pancreatic tumors, computed tomography (CT scans) is commonly used. The detriment of X-ray is long tedious in the manual decision by a radiologist. Robotized classifiers can refresh the analysis action, as far as both precision and time need. This paper is a preliminary to utilize counterfeit neural organization (ANN) and

least squares support vector machine (LSSVM) to naturally characterize 168 human pancreas MR pictures under two classes, either typical or strange pancreas, and the highlights were separated by dim level co-occurrence grid (GLCM). ANN assumes a fundamental part, explicitly in the use of pancreas tumor location. A couple of audits are possible that lead to the improvement of these calculations to upgrade the determination concerning particularity and affectability. LSSVM is an example acknowledgment calculation which figures out how to allot names to objects. Characterization precision contrasts and the two techniques, ANN and LSSVM. ANN gives the best arrangement precision of 96% contrasted with LSSVM. Tumors of the pancreas are extremely difficult to detect in light of the fact that the organ sits deep in the midsection and is taken cover behind different organs. A few symptomatic methods, including imaging tests and blood tests, might be performed to decide whether there is a tumor in the pancreas. Recent different imaging strategies may uncover a mass in the pancreas, the most exact approach to analyze pancreatic malignancy is by considering a biopsied tissue test under the magnifying lens. Understanding the stage (seriousness) of the tumor is critical to picking the best treatment. Pancreatic malignant growth types can be isolated into two bigger classes: exocrine pancreatic disease, which incorporates adenocarcinoma, and neuroendocrine pancreatic malignancy. Every class has a few disease types that may shift in their symptoms, visualization, and prognosis. Staging is a technique for depicting pancreatic malignancy dependent on its size and how far it has metastasized (spread). Pancreatic tumors might be arranged dependent on the aftereffects of different tests and tests. The TNM Organizing Framework from the American Joint Advisory group on Malignancy (AJCC) and the mathematical framework are utilized to portray disease stages [30].

The process of segmenting pancreatic tumors is separated into five parts. The precision of pancreatic segmentation, which was created using deep learning and has over 90% accuracy in CT scans, is a major issue in both clinical picture interpretation and computer-aided diagnosis (CAD). Nonetheless, while representing only a minor fraction of the overall stomach CT scans, pancreas division is a direct result of the significant inconstancy in organ area and life systems. Due to the increasing expansion of the computer aided design framework and the genuine necessity for a medical consultation, a pancreatic image division with an accuracy of above 90% is required. In this article, we developed a novel method for programmed pancreas division of CT images, which combined between/intra-cut logical data with a course neural organization. Fully convolutional neural networks (FCNN) are utilized to retrieve intra-cut logical data for pancreatic division. Recurrent neural networks are adept at distinguishing uncut data from sliced context-oriented data. With a normal dice closeness coefficient (DSC) of 89.72 for the NIH dataset and 4-fold cross-approval, our methodology outperforms the state of expressions of human experience.

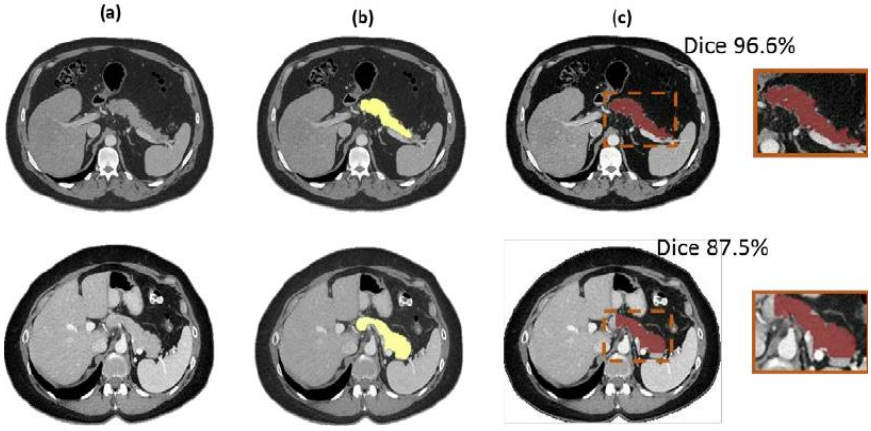


Figure 4: Pancreas segmentation results with the computed Dice coefficients [31]

5. Neural Networks

Neural Networks form a penultimate part of deep learning. A neural network is regarded as a combination of algorithms that aim to recognize the patterns of the operation of a model along with the dataset and establishes a process that works just like a human brain. A neural network requires three parts to function an input layer, hidden layer in the middle and an output layer. These layers are connected to each other using nodes and in turn helps in the formation of a network which is the neural network. It tries to mimic the functioning of a brain.

The act or process of extracting data from data sources for subsequent processing or storage is known as data extraction. We need three datasets from each of our three models for this deep convolution neural network approach. This data will be in the form of MRI scans of the brain, CT scans of the lungs, and x-rays of the pancreas. The task at hand was to obtain large quantities of medically accurate datasets for each of the three models. This dataset will then be divided into ML set with training and testing sets. Data pre-processing is the process which converts the data extracted into a machine readable language so that we can build a ML model. Data pre-processing contains of other three processes which are data cleaning, data transformation and data reduction. Data cleaning is the process of simplifying the data and reducing the errors or blank spaces from the data. Some advantages offered by data cleaning include handles missing data and noisy data. Data transformation is the process of transforming the data type from one format to another. Mostly it refers to the different data types required in the input and as output. Some advantages of data transformation are attribute selection, discretization and supports hierarchy generation. Data reduction is the process of changing the capacity to store the data of the dataset. It improves the storage efficiency and reduces the storage costs. Using this method, the data is stored in such a way that it shows a reduced representation of the dataset but covers all the important and critical information. The other advantages offered by data reduction include dimensionality reduction, numerosity reduction and selection of attribute. Segmentation is the way toward apportioning an image into various significant segments. In clinical or medical imaging, these types of segments frequently compare to various tissue classes, organs, pathologies, or other naturally pertinent constructions. Clinical image segmentation is made troublesome by low differentiation, noise, and other imaging ambiguities. The process of image classification is a very important part in the deep learning model. It is basically as the name suggests classifying the images from the dataset into different classes. This technique helps in the progression of the disease and also helps the doctors in early diagnosis. Shape analysis as of late happen to expanding its role in the medical image analysis area because of its capability to definitely find morphological changes between various populaces of designs, for example sound versus obsessive, female versus male, youthful versus older. This part will be of extraordinary assistance for completing morphological activities between the preparation and testing datasets. A confusion matrix is defined as an even rundown of the quantity of right and erroneous expectations made by a classifier. It tends to be utilized to assess the credibility of the machine learning model through the estimation of execution measurements like exactness, accuracy, review, and F1-score. Data normalization is also an important technique that is used in ML models. This technique is applied during the preparation of a particular dataset so that the model can use the dataset for different data ranges. This makes the readiness of the dataset better and in turn leads to better results.

5.1 Convolution Neural Networks

Convolution neural networks (CNNs) are a widely used and accreted neural network in the field of deep learning. Convolution neural network (CNN) is heavily used in many applications and domains around us. They are mostly used in applications that work on the principles of image classification. Convolution is a mathematical concept which has been developed using machine learning onto programming. Kernels are known as the building blocks of this neural network. Some advantages offered by CNN are that it requires little to very low human intervention and mostly filters the data autonomously. This in a way is very helpful in increasing accuracy substantially. Another advantage of CNN also is that it is able to capture the most spatial features from an image dataset. These features are mostly related to the fact of the pixel and specification arrangement in an image. CNN also adheres to the concept of boundary sharing. To create an element map, a unique filter is applied to various pieces of a contribution.
Convolution neural networks(CNN) are neural networks designed specifically for computer vision. Deep CNNs are known as CNNs with an outsized number of time steps [32].

6. Need of a Disease Prediction Model

Medical image analysis plays an important role in the clinical diagnosis of many diseases such as brain tumour, skin cancer, breast cancer, liver tumour, pancreatic tumour and recently covid-19. The need for a user friendly and multi disease prediction model is something to look forward to where a person can find all of his disease prediction models in one place. Such multi disease prediction models can be developed with the help of a HCNN which can along with a prediction can also perform segmentation operations. The input layer, feature map layer, hidden layer, and output layer make up the HCNN. This neural network is referred to as a hybrid model because, after the output layer, we can run an SVM algorithm in addition to performing the operations of a convolutional neural network. It produces a more accurate and efficient model as shown in figure 5. Instead of a SVM classifier can also use a different machine learning algorithm such as minimum distance classifier, bayes theorem and regression.

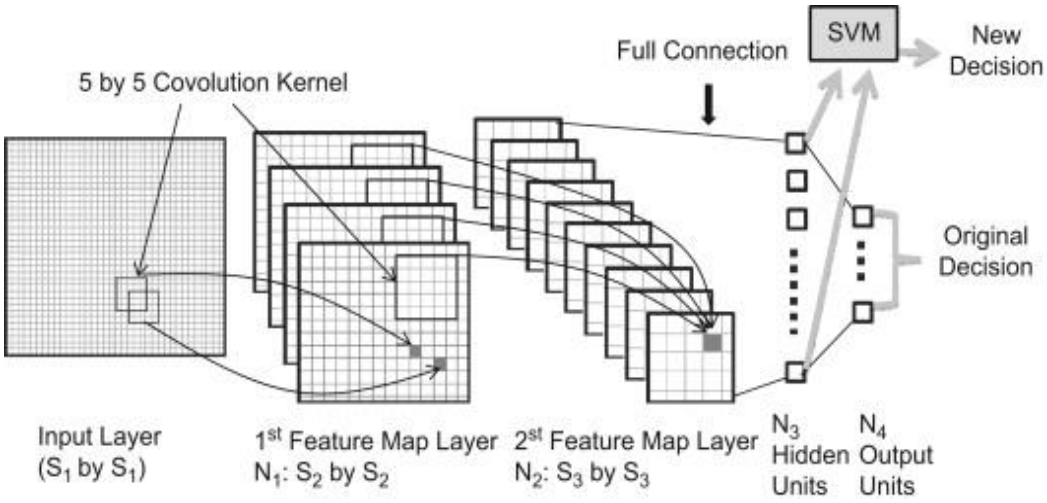


Figure 5: HCNN Algorithm [33]

7. Methodology of the Disease Prediction Model

In this model, we will be proposing a HCNN. This neural network will be created for the process of disease detection from the dataset of images. This images dataset will mostly consist of MRI scans, CT scans and x-rays. We have proposed a HCNN to speed up the training processes. Since our proposed convolution network has been designed to work as a disease detection for three different diseases which include brain tumour, pancreatic tumour and covid-19 we will require a HCNN. Since we have already developed a simple CNNs which are able to give out results of our plan, we have switched our plans to a HCNN which will make it more accurate and trustworthy to predict a particular disease. So far on conducting the required tests and research, we have observed that the HCNN is more capable of speeding up the training processes while maintaining a similar type of performance like in a simple CNN. Neural networks consist of activation functions. An activation function is a very crucial part of a neural network as it suggests from the outputs that weather a neuron will get activated or not and get transferred to the next layer. So, it will be a deciding factor weather the neurons input which is supplied to the network is relevant or not. As a result, selecting and building a neural network with the appropriate activation function is critical. This Neural Network will employ the ReLU activation function. The abbreviation for ReLU is Rectifier Linear Unit. There are various advantages to using the ReLU function. ReLU helps to avoid exponential growth in the computational functions required to run a neural network. Because it does not affect all of the neurons in a neural network at the same time, this activation function is prevalent in predicting deep learning models. This reduces the model's processing time.

7.1 Flowchart of the Disease Prediction Model

In this research paper we have made use of two flowcharts. Generally, flowcharts are used during research in order to represent or explain a particular process. The flowchart is often defined as the representation of an algorithm or a process in the form of a diagram. It describes the step-by-step approach used for solving a task. A flowchart makes use of different geometrical shapes to describe a process.
Below is a flowchart that explains and help us in understanding the working of the neural network.

7.2 Data Extraction

It's essentially a demonstration or cycle for recovering data from data hotspots for additional data preparation or storage. Before moving on to the next stage of the data work process, the import in the transitional separating framework is usually followed by data change and possibly metadata expansion. We used three datasets that were freely available on the internet in this proposed system. We used the COVID-19 Data Repository from Johns Hopkins University's Centre for Systems Science and Engineering (CSSE) for the Covid-19 detection model. For the brain tumour detection model we have made us of the BRaTs dataset 2018 which has been extracted from 19 very popular institutions using the MRI scanners. For the pancreas tumours segmentation we have made us of the NIH Pancreas Segmentation (Pancreas-CT) dataset.

7.3 Data Pre-Processing

Pre-processing data is a significant step forward in the data mining process. In data mining and AI projects, the phrase "garbage in, garbage out" is especially apt. Inexact data-gathering strategies frequently result in out-of-range esteems, incomprehensible data blends, and missing qualities.

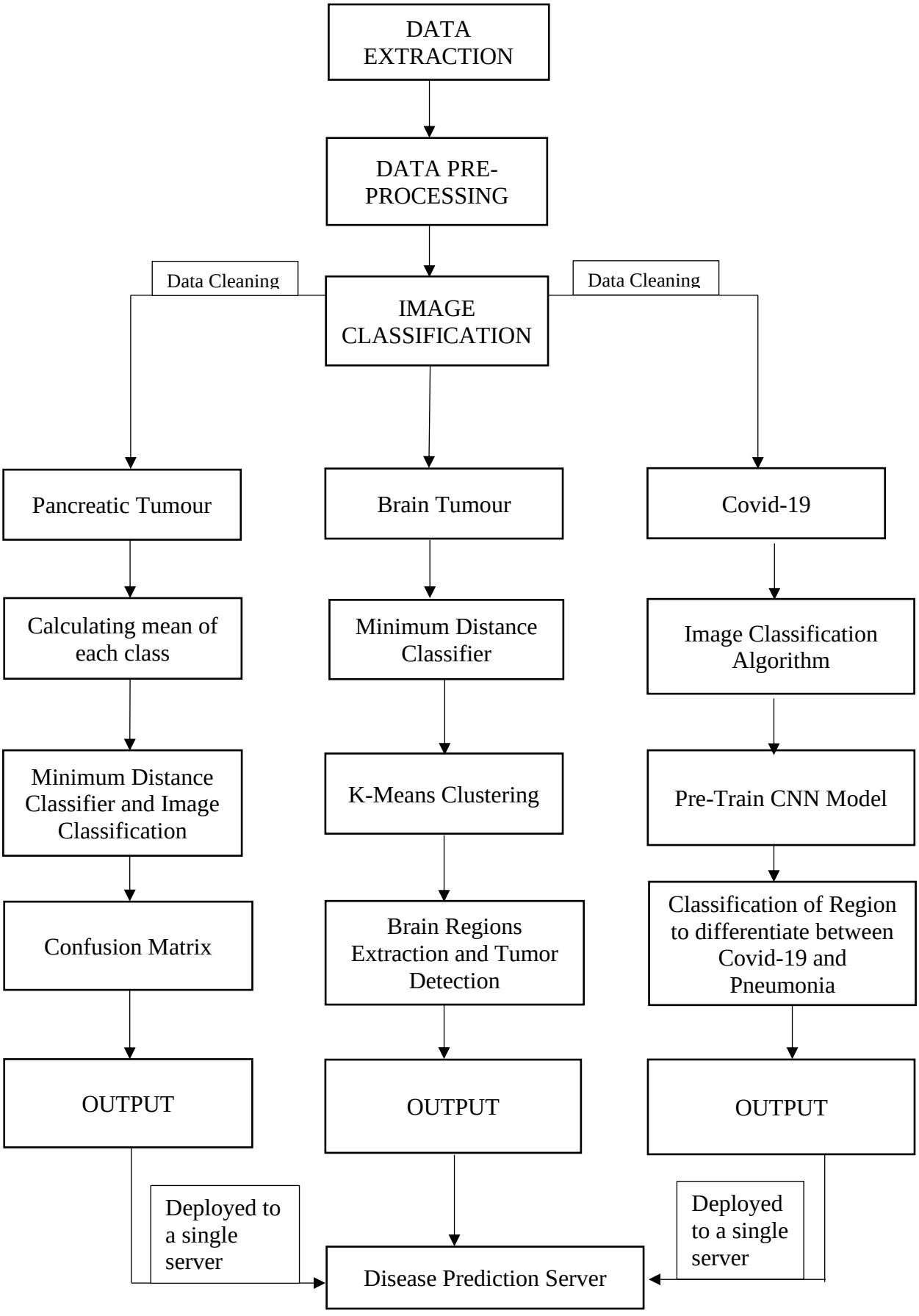


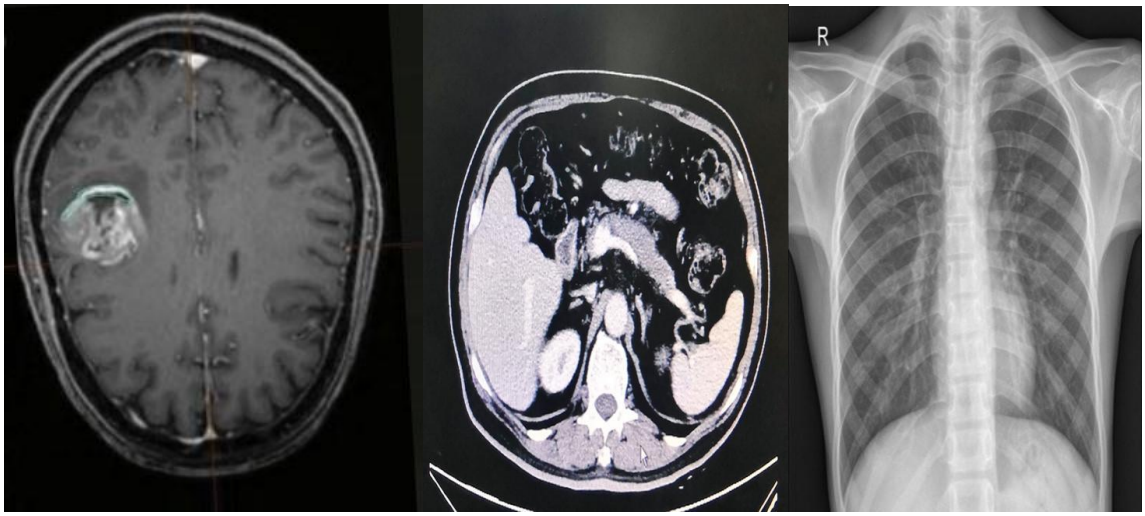
Figure 6: Flowchart for Disease Prediction Model

7.4 Machine Learning Algorithms for Image Classification

These are the algorithms which are used to build the basis of a neural network stronger. These ML algorithms are the ones that are formed using mathematical and statistical concepts. Models created using machine learning are meant to be self-sufficient and more abled to learn and apply the neural network it has been developed upon. A machine learning algorithm develops a model which consists of training and testing datasets. The training sets is meant as a part of dataset that is used for training the model whereas the testing set is the part of dataset used for testing the model and assess its parameters such as accuracy and reliability. Support vector machines often referred to as SVMs. They are supervised machine learning algorithms which can be used for classification and regression models. It is a very strong and powerful algorithm among the other models. It is actively used in image classification models. In python the library used to use this algorithm is scikit-learn library. It is mostly used in object detection and text arrangement-based models [33]. In k-means clustering, k represents the number of clusters formed. For example, if k=4 that means there are 4 clusters. It groups the not labelled dataset into K number of different clusters in a sorted way such that each dataset belongs to only one group that has similar properties. The main point of using this concept is to limit the total distance between the clusters and the actual data points. Some advantages offered by K-means is that it decides the best value for k centroids by an iterative interaction. The particular data points which are close to the specific k-focus, make a cluster [34]. When calculating the distance between a candidate pixel and a class, the minimum distance classifier is frequently utilised. It's just a comparison algorithm that compares each pixel of the input to the pixels of the trained dataset. The input pixels are assigned to the image with the shortest Euclidian distance from the model's trained dataset. Every pixel of the image is evaluated to determine the class assignments. We employed three machine learning techniques, as shown in the flowchart: SVM, minimum distance classifier, and k-means clustering.

8. Working Analysis of the Deep Learning Model

Figure 6 explains the methodology of our HCNN. The database of the three explained diseases has been obtained from the internet. Pancreatic tumour CT scans, Brain tumour MRI scans and Covid-19 x-ray scans can be obtained from educational and data collection sites from online which helps Radiologists, Physicians and Neurologists study the diseases. Below are some of the images from the datasets that have been used.



BRAIN TUMOR **PANCREATIC TUMOR** **COVID-19**

Figure 7: Types of Tumour being considered
Source: http//nature.com/tumors-covid-19

As it can be inferred from the flowchart these images are to be given as input to the system. Then the operations of data processing, Data cleaning and data mining take place. So the first step is data extraction and data pre-processing operations take place. Then the individual operations shown in the flowchart take place. In brain tumour model the process of calculating mean of each class is required to calculate the error and minimize the loss function. Then we calculate the minimum distance classifier which is used to filter other organs or parts in the MRI scan that are seen. Image de-noising is also done to improve or filter out any irregularities in the MRI scan. The operation of K-means clustering is done for prediction and classification analysis. Then the ML model is trained with the training and testing datasets. Then we check the accuracy of the model using the confusion matrix. As the model is trained then the tumour detection operations takes place. The model is then deployed onto a server.

The pancreatic tumour model conducts the following procedures after data pre-processing. We initially calculate the mean of each class to rule out any irregularities or inaccuracies. After that, the minimum distance classifier is utilised. Supervised learning is used to determine the tumorous areas. After that, the model is trained and tested using ML methods. The model's accuracy is measured using the confusion matrix. The model is deployed onto a server after it has been successfully trained and tested, as well as the operation tumour detection. We will use chest x-rays to construct a Covid-19 disease predictor model in the Covid-19 detection model. We'll use chest x-rays to construct a Covid-19 disease predictor model in the Covid-19 detection model. The collection includes three types of x-ray datasets: normal x-rays, Covid-19 x-rays, and pneumonia x-rays. We used a pre-trained CNN to forecast the possibility of pneumonia and Covid-19 using the x-Ray dataset. The Covid-19 prediction model is then created using an image classifier, which filters out the findings.

8.1 Block Diagram of the Disease Prediction Model

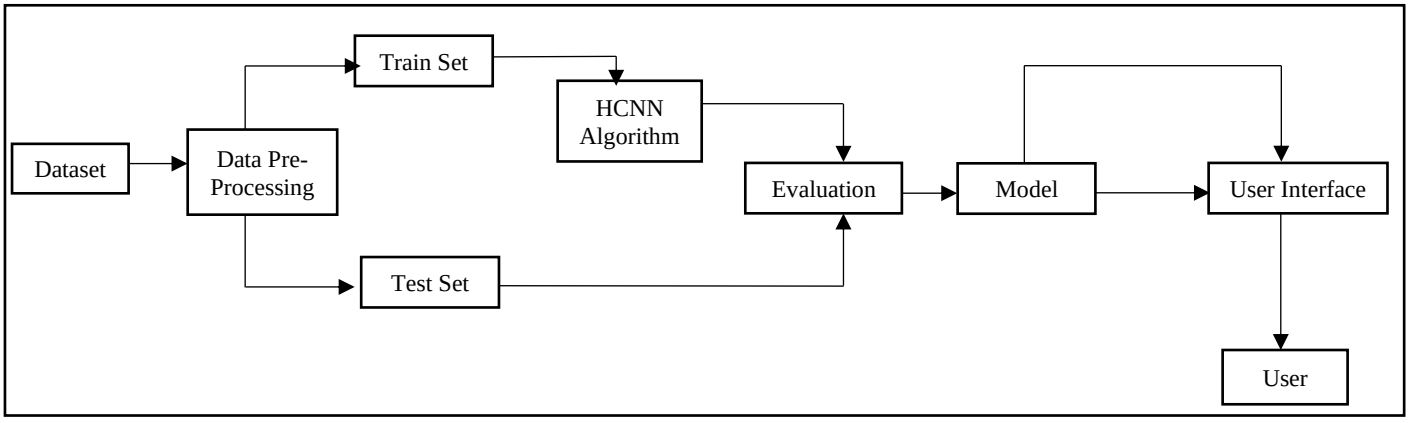


Figure 8: Block diagram for User Operation

Figure 8 describes the user operation of the model in the form of a block diagram. The block diagram has been designed to depict us with a clearer understanding of the application to which the system will be deployed onto.

a. **Train Set and Test Set:** An important part of any DL application is the training and testing dataset. The train and test set has been obtained by dividing the database which was extracted in Flowchart 1 into two parts of the ratio 30 and 70. Here in this case the train set is meant to be a larger database than the test set to increase the accuracy of the model.

b. **HCNN Algorithm and Evaluation:** The HCNN algorithm refers to the hybrid convolution neural network which has been proposed in flowchart 1. This algorithm consists of three parts which combines three different disease prediction models to propose a hybrid convolution neural network. This HCNN algorithm constitutes various different machine learning algorithms such as SVM, minimum distance classifier, regression, bayes theorem among others.
c. **Model and User Interface:** The model which has been built on the HCNN algorithm will then be deployed on a web server using the Django framework. There are two very popular application frameworks which are used to deploy DNN. These are Django and Flask integration. We will be making use of the Django framework because it is known to be very accurate and efficient in terms of deploying a Convolution Neural Network. Another advantage Django can provide will be that in case we need to update the code of our Neural Network it will be easier to update it compared to flask and also the user interface can be developed in a more user friendly on Django. The user interface will be developed using HTML and React JavaScript.

After developing three disease prediction model onto a deep CNN we have a highly accurate and trustworthy model available. Now to increase the usability of our model we will deploy it onto a single server. In order to deploy our model to a server we will be making use of the Django application. The Django application server is very reliable and easy to deploy application which has been designed using the python programming language. Once the system has been successfully deployed onto a Django server then the model will be online and the user from anywhere in the world will be able to use the DL models of his choice by logging into the server. The user will have to first select which disease prediction model they want to use and after selecting the model they will be asked to upload an image of weather their CT scan, MRI scan or x-ray scan based on their need. Then the user can go ahead and run the model on their device to get a highly accurate prediction of their medical scans. Such a model will not only be beneficial to the common man but also to the Doctors to help their diagnosis.

9. Preliminary Data Analysis

0Preliminary data analysis' main tasks are to modify or prepare the data for subsequent analysis, to define the data's major properties, and to summarize the results. A list of the top ten countries that have generated papers on issues connected to disease prediction using digital image processing and other related information is included, as well as a list of the documents and papers released each year.

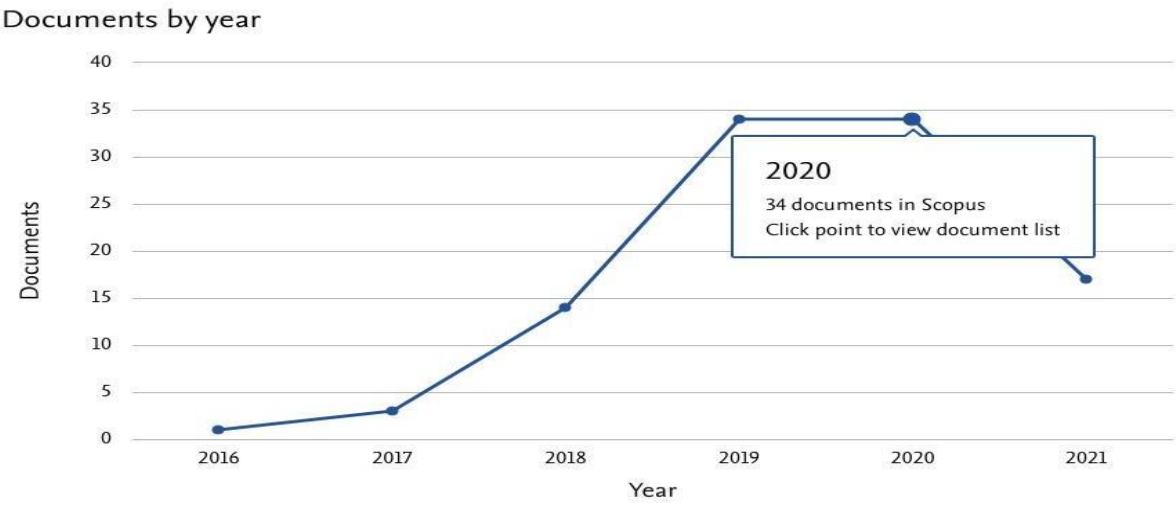


Figure 9 Documents published per year
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 9 depicts the number of documents published each year that are related to or share the same domain as this paper. Since 2016, the number of publications published per year has increased significantly, with 2019 and 2020 seeing the highest number of publications. In 2021, there are 17 publications so far.

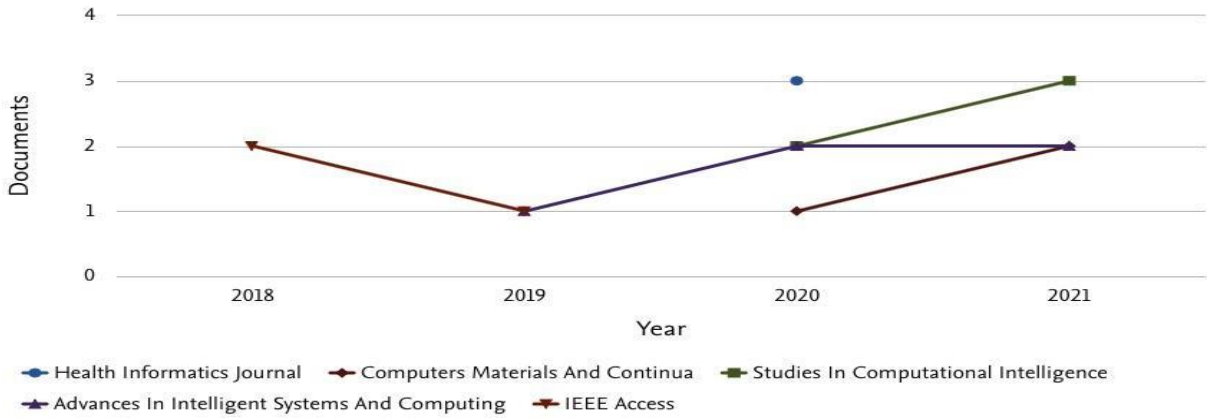


Figure 10 Papers published per year by sources.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

From 2016 to 2021, Figure 10 depicts the number of documents published by various sources per year. The top five sources publishing in this research domain are "IEEE Access," "Health Informatics Journal," "Studies in Computational Intelligence," "Computer Materials and Continuation," and "Advances in Intelligent Systems and Computing."

Table 2 Top 10 countries

\Country	Number of Publications
India	23
Pakistan	4
China	3
Saudi Arabia	3
Iran	2
Poland	2
Australia	1
Egypt	1
Iraq	1
Japan	1

Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

The data for the top ten countries with research papers in this topic can be found in Table 2. India is the country with the most publications, with 23, followed by Pakistan, China, and other nations.

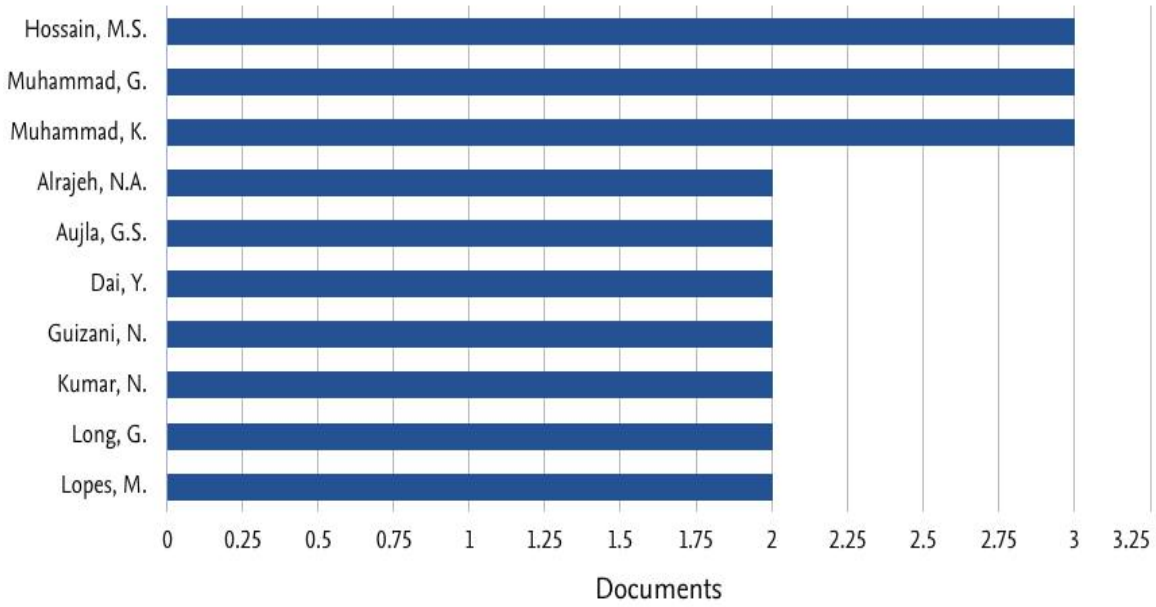


Figure 11. Documents by author.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021

Figure 11 depicts the data of the top authors whose papers on deep learning server based model in healthcare were published. In this research domain, Hossain, M.S., Muhammad, G., and Muhammad, K. have each published three documents, followed by Alrajeh, N.A., Aujla, G.S., and others.

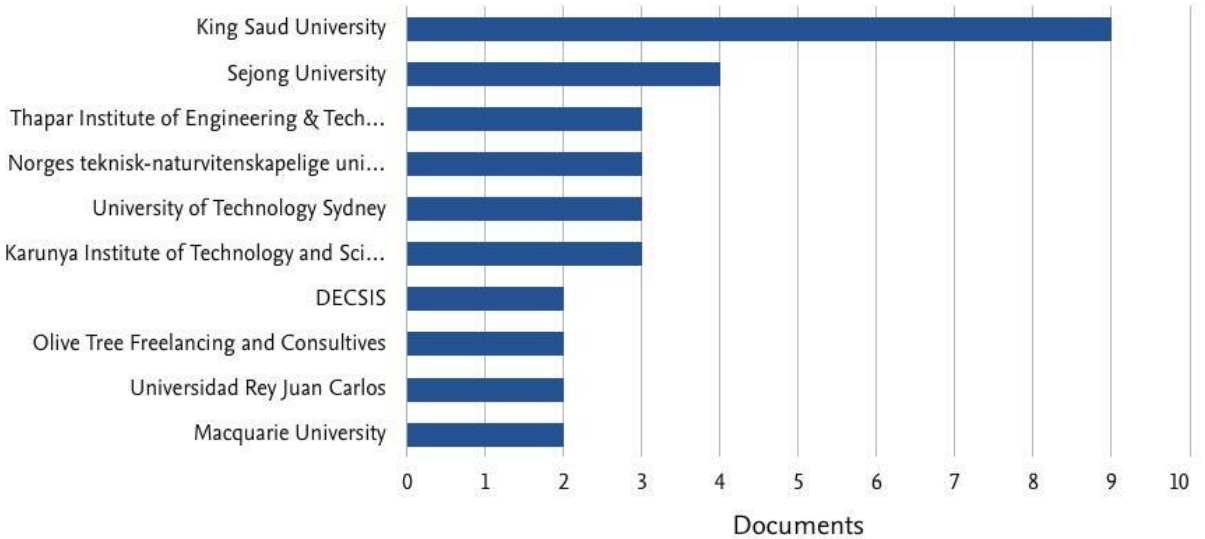


Figure 12. Documents by affiliation.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 12 depicts the data from documents from various sources. With a total of 9 publications, King Saud University leads the way in this field, followed by Sejong University, Thapar Institute of Engineering and Technology in India, and others.

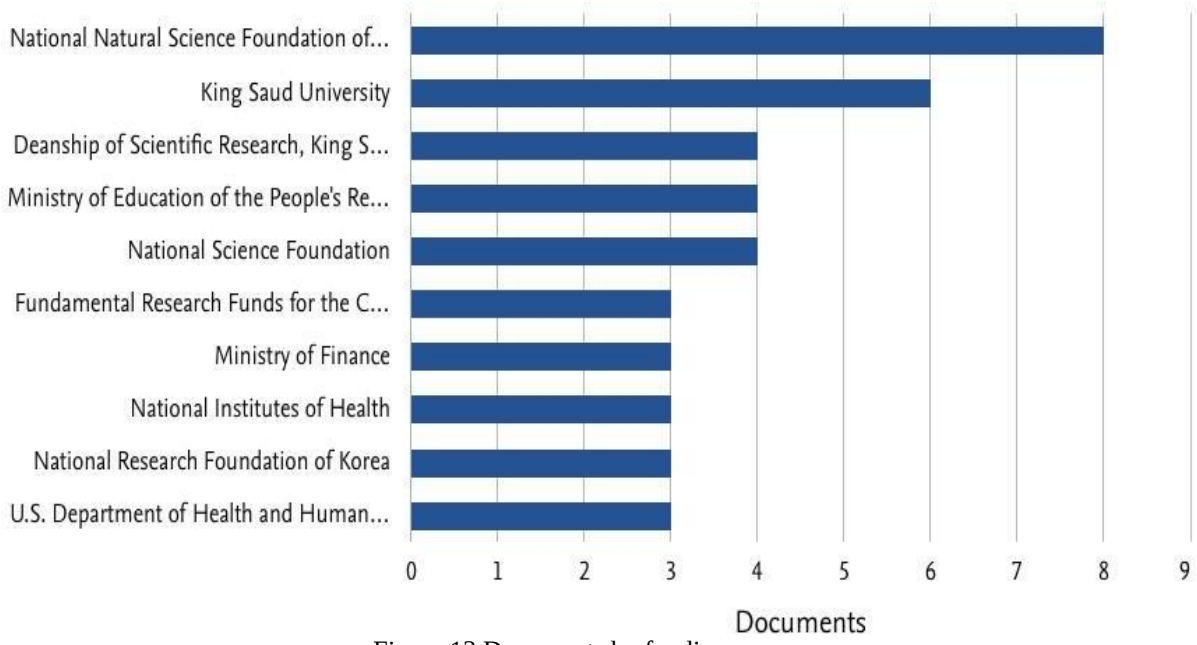


Figure 13 Documents by funding sponsor.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 13 depicts the data from the top ten funding agencies that supported research in this area. With more than 8 publications, China's National Natural Science Foundation ranks first, followed by King Saud University, the Deanship of Scientific Research, and others.

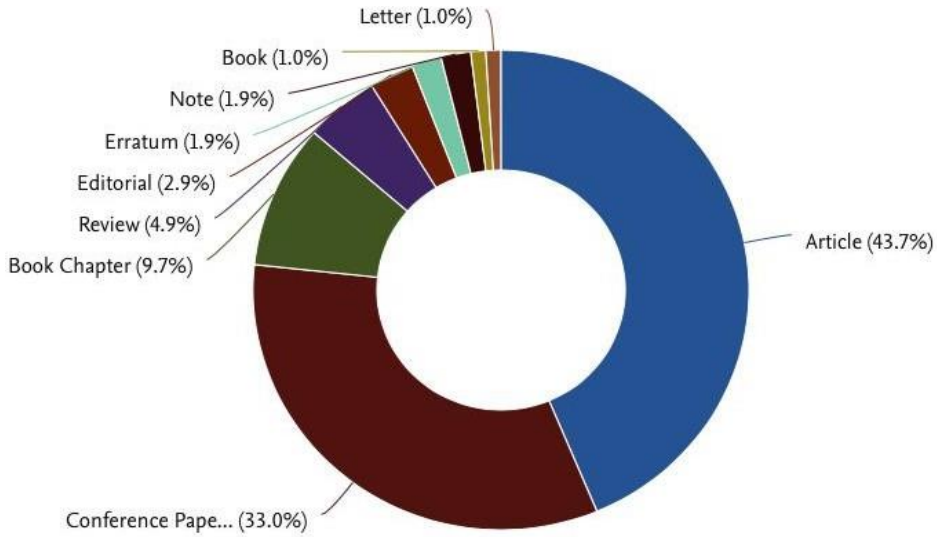


Figure 14 Percentage documents by type.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 14 depicts the percentage of documents that correspond to various kinds. So, it's evident from this pie chart that the most documents were in the form of articles, which accounted for roughly 43.7 percent, followed by conference papers, which accounted for roughly 33 percent, 9.7 percent books, 4.9 percent reviews, and so on.

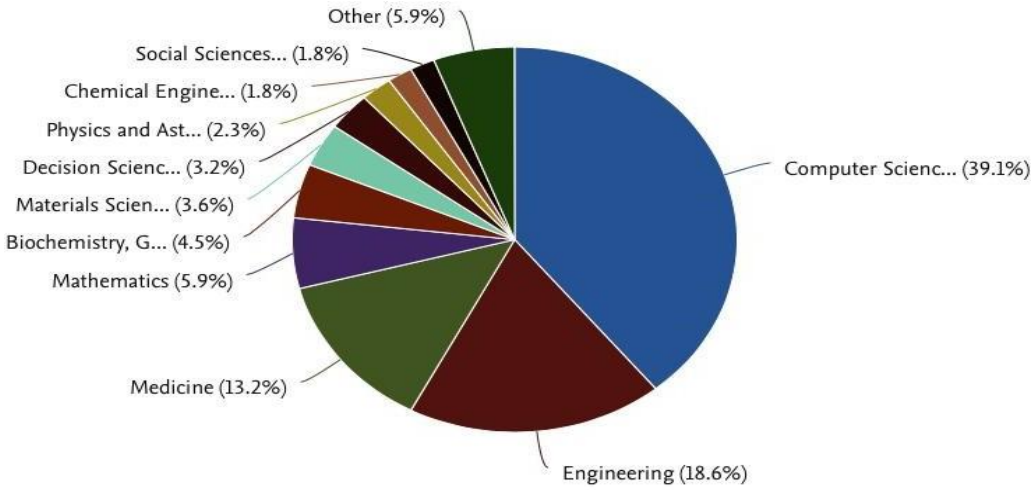


Figure 15 Documents by subject area
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 15 depicts the percentage of documents that correspond to various subject areas. The majority of the documents (39.1%) are in the field of computer science, 18% are in the field of engineering, and 13.2% of the total documents are in the field of medicine.

9.1 Bibliometric Analysis

Bibliometrics is a branch of statistics that analyses publications using statistical calculative methods and software and plug-ins. It makes use of citation data to assess the influence of research outputs.

9.2 Geographical Data Analysis:

Figure 16 Geographical distribution of the study related to Deep Learning that takes place around the world
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

The study in Figure 16 is used to define the geographical places where Deep Learning will be implemented. Figure 8 depicts the regional distribution of the domain-related research. The Indian Subcontinent has the greatest amount of publications. The map above was created with the help of the GPS visualizer plug-in tool and a citation report obtained from the Scopus database.

9.3 Network Analysis

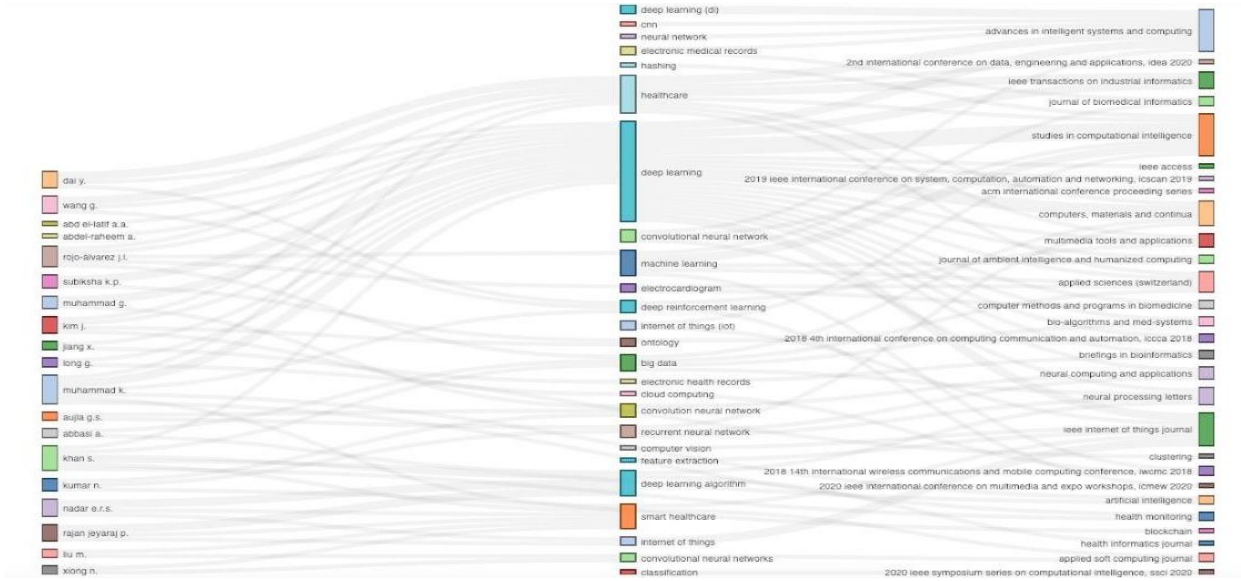


Figure 17 A-K-J Sankey Graph : Main authors, Main Keywords, Main Journals.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 17 is a AKJ Sankey Graph generated using ScienceScape, a data analysis tool for scientific literature. It displays the main authors, main keywords and main journals published by the network formed talks about the keywords used by authors and the keywords occurred in the journals.

Main authors

- **hossain m.s.** (3 papers)
- **kumar n.** (3 papers)
- **muhammad g.** (3 papers)
- **muhammad k.** (3 papers)
- **wang x.** (3 papers)
- **[no author name available]** (2 papers)
- **alrajeh n.a.** (2 papers)
- **aujla g.s.** (2 papers)
- **dai y.** (2 papers)
- **guizani n.** (2 papers)
- **jiang x.** (2 papers)
- **khan s.** (2 papers)
- **kim j.** (2 papers)
- **liu m.** (2 papers)
- **long g.** (2 papers)
- **lopes m.** (2 papers)
- **mendes d.** (2 papers)
- **nadar e.r.s.** (2 papers)
- **rahman m.a.** (2 papers)
- **rajan jeyaraj p.** (2 papers)
- **rodrigues i.p.** (2 papers)
- **rojo-álvarez j.l.** (2 papers)
- **romão a.** (2 papers)
- **subiksha k.p.** (2 papers)
- **wang g.** (2 papers)
- **xiong n.** (2 papers)
- **(jack) li y.-c.** (1 papers)
- **abbasi a.** (1 papers)
- **abd el-latif a.a.** (1 papers)
- **abdel-raheem a.** (1 papers)

Main keywords

- **deep learning** (47 papers)
- **healthcare** (16 papers)
- **machine learning** (10 papers)
- **internet of things** (5 papers)
- **smart healthcare** (5 papers)
- **artificial intelligence** (4 papers)
- **big data** (4 papers)
- **convolutional neural network** (4 papers)
- **internet of things (iot)** (4 papers)
- **classification** (3 papers)
- **cnn** (3 papers)
- **deep learning (dl)** (3 papers)
- **deep learning algorithm** (3 papers)
- **electrocardiogram** (3 papers)
- **neural network** (3 papers)
- **ontology** (3 papers)
- **recurrent neural network** (3 papers)
- **blockchain** (2 papers)
- **cloud computing** (2 papers)
- **clustering** (2 papers)
- **computer vision** (2 papers)
- **convolution neural network** (2 papers)
- **convolutional neural networks** (2 papers)
- **deep reinforcement learning** (2 papers)
- **electronic health records** (2 papers)
- **electronic medical records** (2 papers)
- **encryption** (2 papers)
- **feature extraction** (2 papers)
- **hashing** (2 papers)
- **health monitoring** (2 papers)

Main journals

- **advances in intelligent systems and computing** (5 papers)
- **studies in computational intelligence** (5 papers)
- **computers, materials and continua** (3 papers)
- **health informatics journal** (3 papers)
- **ieee access** (3 papers)
- **ieee network** (3 papers)
- **journal of biomedical informatics** (3 papers)
- **multimedia tools and applications** (3 papers)
- **neural computing and applications** (3 papers)
- **applied sciences (switzerland)** (2 papers)
- **computer methods and programs in biomedicine** (2 papers)
- **ieee internet of things journal** (2 papers)
- **ieee transactions on industrial informatics** (2 papers)
- **journal of ambient intelligence and humanized computing** (2 papers)
- **journal of healthcare engineering** (2 papers)
- **nature medicine** (2 papers)
- **neural processing letters** (2 papers)
- **2018 14th international wireless communications and mobile computing conference, iwcmc 2018** (1 papers)
- **2018 4th international conference on computing communication and automation, iccca 2018** (1 papers)
- **2019 ieee healthcare innovations and point of care technologies, hi-poct 2019** (1 papers)
- **2019 ieee international conference on system, computation, automation and networking, icscan 2019** (1 papers)

Figure 18 Main authors, Main keywords, and Main Journals.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 18 depicts the number of top authors, keywords, and journals in the subject of Deep Learning for healthcare and applications that were filtered out using Scopus, a data analytic tool that provides unrivalled and continuous access to vital research output from around the world.

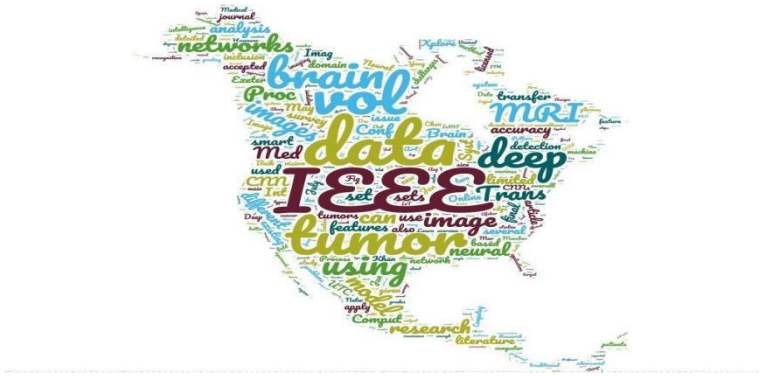


Figure 19 Word Cloud.
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Figure 19 is a word cloud created with the online Word Cloud tool for one of the most often cited documents. IEEE, data, and tumor are the most frequently used words in this document, as indicated by their size.

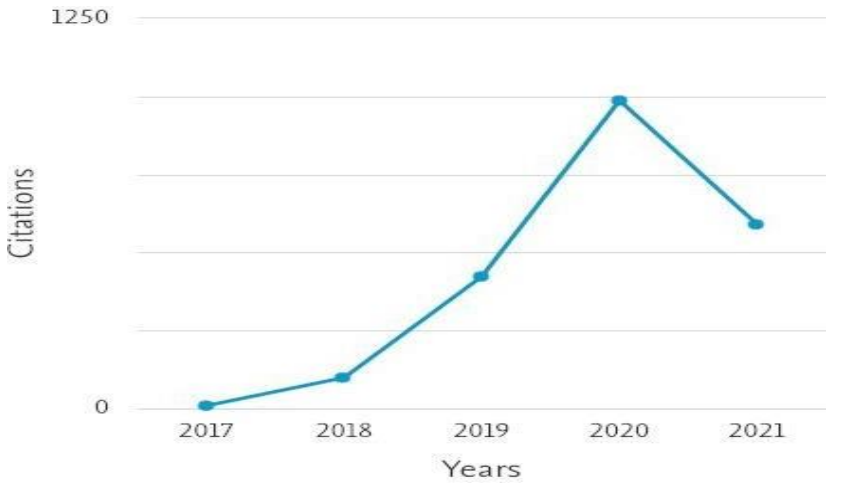


Figure 20 No. of Citations
Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

This graph in Figure 20 shows the number of cited articles observed during our Scopus analysis in the past 5 years.

9.4 Statistical Analysis of publication citation

Table 3. No. of citations per year and total citations

Year	2016	2017	2018	2019	2020	Total
Number of Citations	0	9	99	423	987	2108

Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

In the Scopus Database, Table 3 indicates the number of citations every year. Since 2016, the number of citations has been steadily increasing, with the highest number of documents mentioned in 2020. There has been a total of 519 citations since 2021, with a total of 2108 citations for 103 publications in the Scopus database. With 512 citations, the publication 'Deep Learning for Healthcare: Review, Opportunities, and Challenges' is the most cited in the Scopus database.

Table 4 Citation Analysis of Top 5 publications related to Deep learning Medical Image Analysis

Sr. No.	Publication Year	Publication Title	No. Of citations
1	2017	Deep Learning for healthcare: Review, opportunities and challenges	512
2	2018	A guide to deep learning in healthcare	433
3	2017	Dep Learning for healthcare applications based on psychological signals: A review	304
4	2018	Predicting healthcare trajectories from medical records: A deep learning approach	130
5	2019	An efficient deep learning approach in Pneumonia classification in healthcare	75

Source: http://www.scopus.com (accessed on 15th to 17th May 2021)

Table 4 basically shows the top 5 publications in the field related to the Applications of Disease Detection using digital image processing with the publication title and the publishing year with the respective number of citations for each one of them.

9. Conclusion

HCNN based system ensures a higher value of accuracy in the model. With the observation of large and reliable health datasets not available to the common population in India, we have formulated the HCNN based system will provide greater accuracy and lower use of dataset. Nevertheless, the use of the proposed model does not require any post processing or determination since the predicted model will have less chances of error and refining of result. This is due to the fact that we make use of the U-Net Architecture where the output produced by the algorithm will be of the same format as the input. Right now, we have proposed a system which takes under account three different disease prediction models and provides a conclusive result but such technique can also be used to expand the number of diseases predicted by the system provided we address the complicacy of the algorithm.

We employed a HCNN to construct a disease prediction system that can deal with various diseases on a single server in this research study. Physicians, radiologists, neurosurgeons, and other medical personnel will benefit from the suggested system. This model's accuracy is intended to be higher than that of a traditional neural network. This technique can also be used to cut diagnostic expenses and enhance diagnosis accuracy. In countries such as India where the number of doctors to patient ratio happens to be 1.15 number of doctors per 1000 citizens, such models will come into a positive use as such systems improve the dependency we have

on the doctor and also allows the doctors and healthcare workers to pay higher attention to more complicated cases. It will also improve the que time and help doctors gain a second reliable opinion. This will in turn help in Time Management of the Doctor and Patients. Such a system is a breakthrough in such times where we are highly dependent on technology and Artificial Intelligence.

REFERENCES

[1] Geert Litjens, Thijs Kooi, Babak Ehteshami Bejnordi, Arnaud Arindra Adiyoso Setio, Francesco Ciompi, Mohsen Ghafoorian, Jeroen A.W.M. van der Laak, Bram van Ginneken, Clara I. Sánchez, A survey on deep learning in medical image analysis, Medical Image Analysis, Volume 42, 2017, Pages 60-88, ISSN 1361-8415, https://doi.org/10.1016/j.media.2017.07.005.

[2] Heba Mohsen, El-Sayed A. El-Dahshan, El-Sayed M. El-Horbaty, Abdel-Badeeh M. Salem, "Classification using deep learning neural networks for brain tumors", Future Computing and Informatics Journal, Volume 3, Issue 1, 2018, Pages 68-71, ISSN 2314-7288, https://doi.org/10.1016/j.fcij.2017.12.001.

[3] S. Das, O. F. M. R. R. Aranya and N. N. Labiba, "Brain Tumor Classification Using Convolutional Neural Network," 2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT), 2019, pp. 1-5, doi: 10.1109/ICASERT.2019.8934603.

[4] N. Kumaravel, K. S. Sridhar and N. Nithiyanandam, "Automatic diagnosis of heart diseases using neural network," Proceedings of the 1996 Fifteenth Southern Biomedical Engineering Conference, 1996, pp. 319-322, doi: 10.1109/SBEC.1996.493214.

[5] Alex Fornito, Andrew Zalesky, Edward T. Bullmore, Chapter 1 - An Introduction to Brain Networks, Fundamentals of Brain Network Analysis, Academic Press, 2016, Pages 1-35, ISBN 9780124079083, https://doi.org/10.1016/B978-0-12-407908-3.00001-7.

[6] Sajjad, Muhammad & Khan, Salman & Muhammad, Khan & Wu, Wanqing & Ullah, Amin & Baik, Sung. (2018). "Multi-Grade Brain Tumor Classification using Deep CNN with Extensive Data Augmentation," Journal of Computational Science. 30. 10.1016/j.jocs.2018.12.003.

[7] Özyurt, Fatih & Kutlu, Hüseyin & Avci, Engin & Avci, Derya. (2018). A New Method for Classification of Images Using Convolutional Neural Network Based on Dwt-Svd Perceptual Hash Function. 410-413. 10.1109/UBMK.2018.8566537.

[8] Lu, Xiaojun & Duan, Xu & Mao, Xiuping & Li, Yuanyuan & Zhang, Xiangde. (2017), "Feature Extraction and Fusion Using Deep Convolutional Neural Networks for Face Detection", Mathematical Problems in Engineering, 2017, 1-9, 10.1155/2017/1376726.

[9] Huan, Er-Yang & Wen, Gui-Hua & Zhang, Shi-Jun & Li, Dan-Yang & Hu, Yang & Chang, Tian-Yuan & Wang, Qing & Huang, Bing-Lin. (2017) "Deep Convolutional Neural Networks for Classifying Body Constitution Based on Face Image", Computational and Mathematical Methods in Medicine,2017,Pages: 1-9, 10.1155/2017/9846707.

[10] Bhandari, A., Koppen, J. & Agzarian, M. Convolutional neural networks for brain tumor segmentation. *Insights Imaging* 11, 77(2020) https://doi.org/10.1186/s13244-020-00869-4

[11] Liang, Hong & Sun, Xiao & Yunlei, Sun & Gao, Yuan. (2017). Text feature extraction based on deep learning: a review. EURASIP Journal on Wireless Communications and Networking. 2017. 10.1186/s13638-017-0993-1.

[12] Mohsen, Heba & El-Dahshan, El-Sayed & El-Horbarty, El-Sayed & M.Salem, Abdel-Badeeh. (2017), "Brain Tumor Type Classification Based on Support Vector Machine in Magnetic Resonance Images", Annals of Dunarea de Jos University of Galati Fascicle II, Year IX.

[13] Y. Xu, Z. Jia, Y. Ai, F. Zhang, M. Lai and E. I. Chang, "Deep convolutional activation features for large scale Brain Tumor histopathology image classification and segmentation", *2015 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, 2015, pp. 947-951, doi: 10.1109/ICASSP.2015.7178109.

[14] L. Deng, "Artificial Intelligence in the Rising Wave of Deep Learning: The Historical Path and Future Outlook", *IEEE Signal Processing Magazine*, Volume 35, Issue 1, Page: 177-180, 2018.

[15] Shaik Basheera and M. Satya Sai Ram 2019, Journal of Physics: Conference Series, Volume 1172, International Conference on Applied Physics, Power and Material Science, Pages: 5–6 December 2018.
[16] S. Das, O. F. M. Riaz Raheman, Aranya and N. N. Labiba, "Brain Tumor Classification Using Convolutional Neural Network", *2019 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT)*, 2019, Pages: 1-5, doi: 10.1109/ICASERT.2019.8934603.
[17] S. Pereira, A. Pinto, V. Alves and C. A. Silva, "Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images", *IEEE Transactions on Medical Imaging*, Volume 35, Issue 5, Pages: 1240-1251, May 2016, doi: 10.1109/TMI.2016.2538465.
[18] Jeenal Shah, Sunil Surve, Varsha Turkar, Pancreatic Tumor Detection Using Image Processing, Procedia Computer Science, Volume 49, 2015, Pages 11-16, ISSN 1877-0509, https://doi.org/10.1016/j.procs.2015.04.221.
[19] Desai, Sudhen & Pareek, Anuj & Lungren, Matthew, 2020, Deep learning and its role in COVID-19 medical imaging, Intelligence-Based Medicine, Pages: 3-4. 10.1016/j.ibmed.2020.100013.
[20] Y. Pan, "Brain tumor grading based on Neural Networks and Convolutional Neural Networks", *2015 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2015, Pages: 699-702, doi: 10.1109/EMBC.2015.7318458.
[21] J. Ker, L. Wang, J. Rao and T. Lim, "Deep Learning Applications in Medical Image Analysis" *IEEE Access*, Volume 6, Pages: 9375-9389, 2018, doi: 10.1109/ACCESS.2017.2788044.
[22] Mohammad Rahimzadeh, Abolfazl Attar, A modified deep convolutional neural network for detecting COVID-19 and pneumonia from chest X-ray images based on the concatenation of Xception and ResNet50V2, Informatics in Medicine Unlocked, Volume 19, 2020, 100360, ISSN 2352-9148, https://doi.org/10.1016/j.imu.2020.100360.
[23] M. M. Leonardo, T. J. Carvalho, E. Rezende, R. Zucchi and F. A. Faria, "Deep Feature-Based Classifiers for Fruit Fly Identification (Diptera: Tephritidae)", *2018 31st SIBGRAPI Conference on Graphics, Patterns and Images (SIBGRAPI)*, 2018, Pages: 41-47, doi: 10.1109/SIBGRAPI.2018.00012.
[24] Corley, Courtney & Pullum, Laura & Hartley, David & Benedum, Corey & Noonan, Christine & Rabinowitz, Peter & Lancaster, Mary, 2014, "Disease Prediction Models and Operational Readiness", Volume 9, e91989. 10.1371/journal.pone.0091989.
[25] Basir, Otman & Shantta, Kalifa, "Deep Learning Feature Extraction for Brain Tumor Characterization and Detection", *IRA-International Journal of Applied Sciences*, vol. 16, p. 1, 2021.
[26] R. Srinivasaiah, "Hybrid data mining model for the classification and prediction of medical datasets", *International Journal of Knowledge Engineering and Soft Data Paradigms* , Volume 5, Pages 262, 2016.
[27] Mohammad Havaei, Axel Davy, David Warde-Farley, Antoine Biard, Aaron Courville, Yoshua Bengio, Chris Pal, Pierre-Marc Jodoin, Hugo Larochelle, Brain tumor segmentation with Deep Neural Networks, Medical Image Analysis, Volume 35, 2017, Pages 18-31, ISSN 1361-8415, https://doi.org/10.1016/j.media.2016.05.004.
[28] Ghadezadeh, Mustafa & Asadi, Farkhondeh. (2020). Deep Learning in Detection and Diagnosis of Covid-19 using Radiology Modalities: A Systematic Review.
[29] Katsamenis, Iason & Protopapadakis, Eftychios & Voulodimos, Athanasios & Doulamis, Anastasios & Doulamis, Nikolaos, 2020, "Transfer Learning for COVID-19 Pneumonia Detection and Classification in Chest X-ray Images", 10.1101/2020.12.14.20248158.
[30] Wei Liu &. Z. Zhao, "Pancreatic Cancer: A Review of Risk Factors, Diagnosis, and Treatment", SAGE JOURNAL, 2021.
[31] Farag, L. Lu, H. R. Roth, J. Liu, E. Turkbey and R. M. Summers, "A Bottom-Up Approach for Pancreas Segmentation Using Cascaded Superpixels and (Deep) Image Patch Labeling" IEEE Transactions on Image Processing, Volume 26, Issues 1, Pages: 386-399, Jan. 2017, doi: 10.1109/TIP.2016.2624198.
[32] S. Albawi, T. A. Mohammed and S. Al-Zawi, "Understanding of a convolutional neural network", 2017 International Conference on Engineering and Technology (ICET), 2017, Pages 1-6, doi: 10.1109/ICEngTechnol.2017.8308186.

[33] Savita, Ahlawat & Choudhary, Amit. (2020), Hybrid CNN-SVM Classifier for Handwritten Digit Recognition, Procedia Computer Science, Volume 167, Pages: 2554-2560, 10.1016/j.procs.2020.03.309.
[34] Uysal, İlhan & Güvenir, Halil Altay, 1999, An overview of regression techniques for knowledge discovery, Knowledge Engineering Review, Volume 14, Pages: 319-340. 10.1017/S026988899900404X.
[35] Shrintinsky, "Physica D: Nonlinear Phenomena," *Physica D: Nonlinear Phenomena*, Volume 404, 2020.
[36] P. S. Praveen Kumar, "Artificial Neural Networks – A study,"*International Journal of Emerging Engineering Research and Technology",* Volume 2, Pages: 143-148, 2014